Hiroshi IKEDA*: **Chromosome numbers of the Himalayan *Potentilla* (Rosaceae)****

池田 博*: ヒマラヤ産キジムシロ属（バラ科）の染色体数

Polyploidy is considered as one of the course of speciation, and ploidy level is reported to become higher with elevation from the sea level (Hagerup 1932, Tischler 1935). But cytological studies of Himalayan alpine species are very scarce (Wakabayashi 1988), and only Wakabayashi & Ohba (1988) published a comprehensive paper on the cytotaxonomy of the alpine *Saxifraga*. They, however, concluded that polyploidy did not play an important role in the species diversification of that genus.

The genus *Potentilla* is known for its variation in ploidy level, i.e., diploid (2n=14), tetraploid (2n=28), hexaploid (2n=42) and other higher polyploids (Müntzing 1928, Shimotomai 1929, 1930a, 1930b), and the relationship between the chromosome numbers and its phylogeny has been discussed (Shimotomai 1930a, 1930b). *Potentilla*, one of the largest genera of Rosaceae, includes about three hundred species (Wolf 1908) which are concentrated in the temperate to alpine zones of the Northern Hemisphere. Twenty five species are reported from Nepal Himalaya (Ohashi 1979), and most are distributed in the alpine region. Thus, *Potentilla* is one of the representative taxa in the Himalayas, and fit for the study of cytological diversity and speciation.

In 1988, I had an opportunity to make a field study in eastern and central Nepal as a member of a co-operative botanical research team (leader: Dr. Mitsuo Suzuki). and could collect materials to count chromosome numbers. This paper aims to report chromosome numbers of thirteen taxa of Himalayan *Potentilla*.

Materials and methods Localities and voucher specimens of the investigated plants are shown in Tab. 1. Root-tips were fixed in the field between middle July and early September in 1988 following Wakabayashi's method (see Wakabayashi & Ohba 1988). Root-tips were pretreated with 0.05% colchicine solution

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Tab. 1. Localities, chromosome numbers and voucher specimens of the plants examined.

Taxon	Locality (all in Nepal) and the number of specimen	Chromosome number
Sect. Trichocarpae		
Subsect. Rhopalostylae		
P. fruticosa L.		
var. *rigida* (Wall.) Wolf	Merek, 4350 m alt., 8880655	2n=28
Subsect. Nematostylae		
P. biflora Willd. ex Lehm.	Yak Kharka, 4230 m alt., 8881658	2n=14
P. cuneata Wall. ex Lehm.	Phemathang Kharka, 3210 m alt., 8880617	2n=28
P. eriocarpa Wall. ex Lehm.		
var. *eriocarpa*	Yak Kharka, 4230 m alt., 8881664	2n=14, 28
var. *major* Kitam.	ibid., 3450 m alt., 8881697	2n=56
Sect. Gymnocarpae		
Subsect. Closterostylae		
P. fulgens Wall. ex Hook.	Banthanti, 2600 m alt., 8881244	2n=14
P. polyphylla Wall. ex Lehm.	Khongma, 3500 m alt., 8880571	2n=28
Subsect. Leptostylae		
P. peduncularis D. Don	Cha Ding Kharka, 3970 m alt., 8880802	2n=28
P. microphylla D. Don		
var. *achilleifolia* Hook. f.	Lyang Mo Le Kharka, 4200 m alt., 8880667	2n=14
P. coriandrifolia D. Don	Cha Ding Kharka, 3970 m alt., 8880800	2n=56
P. monanthes Wall. ex Lehm.		
var. *monanthes*	Shersing Kharka, 4510 m alt., 8880727	2n=42
var. *sibthorpioides* Hook. f.	Merek, 4500 m alt., 8880679	2n=14
P. Kleiniana Wight	Bhotebas, 1800 m alt., 8880264	2n=28

for 1.5-3.0 hours, and were fixed with Newcomer's fluid (see Sharma & Sharma 1980). This fluid was replaced after one week with a fresh one in order to cleanse the root-tips. The fixed roots were hydrolysed with 1N HCl at 60°C for 10.5 minutes, stained with leuco-basic fuchsin and 2% aceto-orcein, and then squashed for cytological observation.

Results and discussion Chromosome numbers of thirteen taxa of Himalayan *Potentilla* were counted and are presented in Tab. 1. The chromosomes observed in a somatic cell of each taxon are shown in Figs. 1 & 2. Length of the chromosomes are very short, approximately from 1 μm to 3 μm long.

As stated by Asker (1970), it is very difficult to stain chromosomes of *Potentilla*. In this study I used the double staining method, but the stainability was not so improved. Karyomorphological analysis was not possible because it was difficult to make pretreatment and fixing in the same condition in the field. Chromosome numbers counted were 2n=14, 28, 42 and 56. Of the thirteen taxa, four (*P. biflora, P. fulgens, P. microphylla* var. *achilleifolia, F. monanthes* var. *sibthorpioides*) were diploids (2n=14), five (*P. fruticosa* var. *rigida, P. cuneata, P. polyphylla, P. peduncularis, P. Kleiniana*) were tetraploids (2n=28), one (*P. monanthes* var. *monanthes*) was hexaploid (2n=42), and two (*P. eriocarpa* var. *major, P. coriandrifolia*) were octaploids (2n=56). Chromosome number of *P. eriocarpa* var. *eriocarpa* was counted as 2n=14 and 28 in the same population.

Chromosome number of eight taxa (six species and two varieties as *P. cuneata, P. eriocarpa* var. *eriocarpa* and var. *major, P. peduncularis, P. microphylla* var. *achilleifolia, P. coriandrifolia, P. monanthes* var. *monanthes* and var. *sibthorpioides*) were counted for the first time. One species (*P. fulgens*) was counted as 2n=14, which was different from the former reports: it was 2n=56 by Popoff (1939) and n=14 (counted in a gametophytic cell) by Sharma & Sarker (1967-68).

In two species, different chromosome numbers were discovered between varieties. Chromosome number of *P. eriocarpa* var. *eriocarpa* was counted as 2n=14, 28, while that of var. *major* was 2n=56. Morphological, ecological and cytological data suggests that these two varieties under *P. eriocarpa* should be regarded as independent species (Ikeda unpublished).

Chromosome number of *P. monanthes* var. *monanthes* was counted as 2n=42, and that of var. *sibthorpioides* was 2n=14. Length of the chromosomes

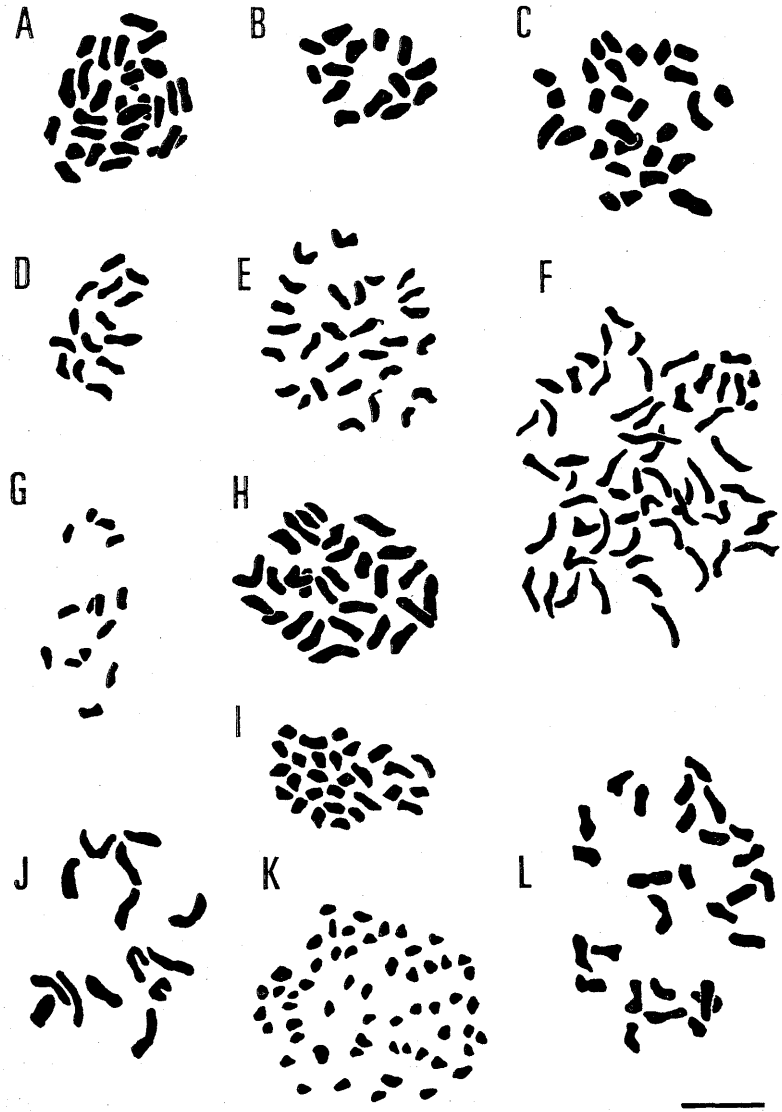

Fig. 1. Chromosomes of Himalayan *Potentilla*. A: *P. fruticosa* var. *rigida*, 2n=28. B: *P. biflora*, 2n=14. C: *P. cuneata*, 2n=28. D, E: *P. eriocarpa* var. *eriocarpa*, 2n=14, 28. F: *P. eriocarpa* var. *major*, 2n=56. G: *P. fulgens*, 2n=14. H: *P. polyphylla*, 2n=28. I: *P. peduncularis*, 2n=28. J: *P. microphylla* var. *achilleifolia*, 2n=14. K: *P. coriandrifolia*, 2n=56. L: *P. Kleiniana*, 2n=28. Bar indicates 5 μm.

were quite different between these two varieties. Chromosomes of var. *monanthes* are 1.1–2.3 μm long, while those of var. *sibthorpioides* are 1.0–1.1 μm long (see Fig. 2). Var. *sibthorpioides* is a small herb and grows on stable places of a slope. On the other hand, var. *monanthes* is a rather large herb and grows in plain grasslands where domestic animals graze in summer. It is said that amphiploids grow in disturbed habitats, while diploids grow in stable places (Johnson & Packer 1965). It is probable that var. *monanthes* has been derived from the hybrid between var. *sibthorpioides* and the other unknown parental species.

Shimotomai (1930a) pointed out that species in Sect. Trichocarpae and Subsect. Closterostylae have low chromosome numbers because of their primitiveness. But the results of this study do not support this. As shown in Tab. 1,

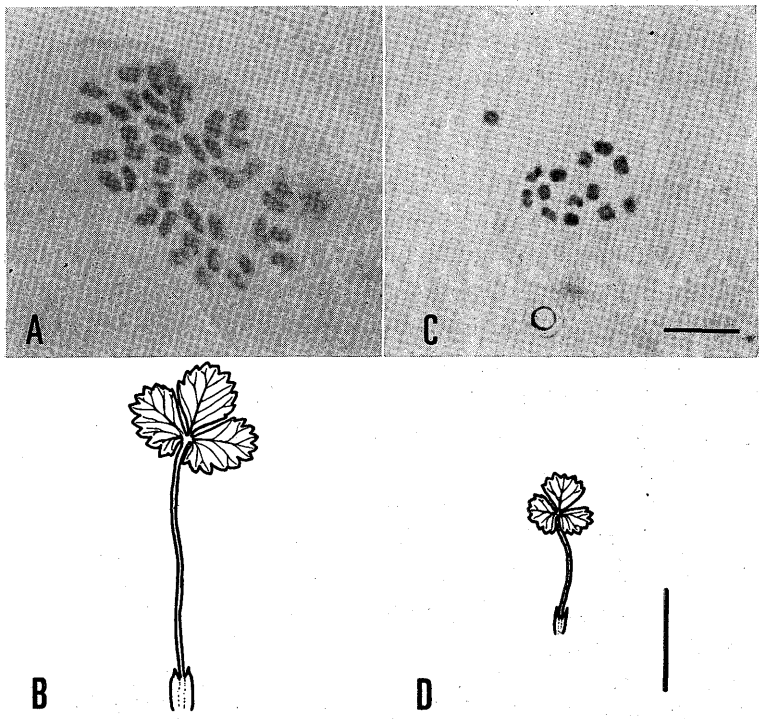

Fig. 2. Chromosomes and representative leaves of *Potentilla monanthes*. A, B: var *monanthes*, 2n=42. C, D: var. *sibthorpioides*, 2n=14. Bars indicate 5 μm (above) and 2 cm (below).

chromosome numbers and infrageneric taxa do not correlate apparently.

Tischler (1935) explained that polyploidy is instrumental in adapting plants to life under the harsh conditions of arctic and alpine regions. But Gustafsson (1948) and Favarger (1957) found no difference in the frequency of polyploidy between high places and surrounding lowlands. A similar result was obtained by Wakabayashi and Ohba (1988) in the Himalayan alpine *Saxifraga*. In *Potentilla*, the above results also show that polyploidy does not play an important role in speciation at least in the Himalayan alpine region.

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バラ科キジムシロ属 (*Potentilla* L.) はヒマラヤ地域において高山帯で多様化した分類群であり，ヒマラヤ高山帯における細胞学的多様性と種分化の関係とを考える上で良い材料になると思われる。今回ヒマラヤ産キジムシロ属13分類群について染色体数を観察したので報告する。

染色体数を観察した分類群と染色体数は次の通りである。*P. fruticosa* var. *rigida* (2n=28), *P. biflora* (2n=14), *P. cuneata* (2n=28), *P. eriocarpa* var. *eriocarpa* (2n=14, 28) および var. *major* (2n=56), *P. fulgens* (2n=14), *P. polyphylla* (2n=28), *P. peduncularis* (2n=28), *P. microphylla* var. *achilleifolia* (2n=14), *P. coriandrifolia* (2n=56), *P. monanthes* var. *monanthes* (2n=42) および var. *sibthorpioides* (2n=14), *P. Kleiniana* (2n=28)。このうち，今回新たに観察されたものは6種2変種であった。

P. eriocarpa は，従来変種として var. *eriocarpa* と var. *major* が知られていたが，外部形態，生態，染色体数の上から別種であるという推定がなされた。

P. monanthes は var. *monanthes* と var. *sibthorpioides* とがあるが，var. *monanthes* は 2n=42 の6倍体，var. *sibthorpioides* は 2n=14 の2倍体であることがわかった。

属内分類群と倍数性との関連は明らかには認められなかった。また，倍数性と生育地の標高との関係についても，標高が上がるにつれて倍数性も上がるような傾向は見いだせなかった。